

Chapter 3—Refuge Resources and Description



Tom Koerner / FWS

Elk

This chapter describes the resources of Cokeville Meadows Refuge in Wyoming, which share many characteristics with the greater Bear River watershed.

3.1 Physical Environment

Cokeville Meadow Refuge is located in Lincoln County, Wyoming, near Utah and Idaho. It is just south of the town of Cokeville, and both are so named for nearby coal deposits. The refuge consists of 9,259 fee-title and conservation easement acres within the Bear River watershed, which has a drainage area of about 4.8 million acres in Wyoming, Utah, and Idaho.

Climate

The climate of the Cokeville Meadows region is semiarid, midcontinental (FWS 1992). Most precipitation that falls in the region is of Pacific origin; average annual precipitation is about 12 inches, with

ranges from 9 to 18 inches annually. The area is dry most of the year. About 38 percent of precipitation occurs as rainfall from April to June. In winter, gusty winds can produce blizzards and drifting snow. The frost-free season is only 60–70 days.

Days are generally clear and sunny (about 250 days per year) and evaporation rates are high in the summer. Monthly average relative humidity ranges from 35 percent in July to about 75 percent in December. Mean monthly pan evaporation rates have a seasonal total of 31.3 inches, which is nearly three times that of annual precipitation. Temperatures are often below 0 °F in winter and can exceed 90 °F in mid-summer. Annual mean temperature is 38 °F.

The combination of low precipitation, high evaporation, and high summer temperatures leads to scant free-standing surface water from summer through winter.

Climate Change

The Secretary of the Interior issued an order in January 2010 requiring U.S. Department of the Interior agencies with land management responsibilities to consider the effects of a potential climate change as part of their long-range planning endeavors. The

Department of Energy's report, "Carbon Sequestration Research and Development," concluded that ecosystem protection is important to carbon sequestration and may reduce, or prevent, the loss of carbon now stored in the terrestrial biosphere (U.S. Department of the Interior 2010).

Some members of the atmospheric sciences community believe that an increase in the average amount of carbon dioxide (CO₂) could lead to the gradual rise in the world's surface temperature and commonly refer to this scenario as "climate change." In relation to comprehensive conservation planning for Refuge System units, carbon sequestration constitutes the primary climate-related effect to be considered in planning.

Vegetated land is a tremendous factor in carbon sequestration. Large, naturally occurring communities of green plants that occupy major habitats—grasslands, forests, wetlands, and tundra—are effective both in preventing carbon emission and in acting as biological "scrubbers" of atmospheric carbon dioxide.

One habitat management activity in particular found in many wildlife refuges throughout our Nation—prescribed fire—releases carbon dioxide directly into the atmosphere from the biomass consumed during combustion. However, there is no net loss of carbon because new vegetation quickly germinates and sprouts to replace the burned biomass. This vegetation sequesters an approximately equal amount of carbon as was lost to the air (Dai et al. 2006).

Some other potential effects of a change in climatic conditions may need to be considered in the future, including:

- Habitat available in lakes and streams for cold-water fish such as trout and salmon could be reduced.
- The composition of vegetation in forested areas may change, with some plant species shifting their range northward or dying out and other plant species moving in to take their place.
- Ducks and other waterfowl could lose breeding habitat because of stronger and more frequent droughts.
- Changes in the phenology of migration and nesting could put some birds out of synchronization with the life cycles of their prey and the habitat conditions that are conducive to their reproductive cycles.

Land Features

Cokeville Meadows Refuge is located in the Bear River Valley in southwestern Wyoming on a 20-mile stretch of the Bear River, which flows into the Great Salt Lake and is the largest river in the Western Hemisphere that flows into an inland sea. The headwaters of the Bear River are in the Uinta Mountains in northern Utah (Laabs et al. 2007). The river flows northward into southwestern Wyoming and passes near Evanston before looping back into Utah. As the river continues northward, it flows back into Wyoming just north of U.S. Highway 30 southwest of the town of Cokeville. The southern edge of the Cokeville Meadows Refuge acquisition boundary is near the site where the Bear River enters Wyoming. After leaving the northern Cokeville Meadows Refuge acquisition boundary, the river loops into Idaho and then descends southward into Utah, and flows generally south and westward near Logan, Utah, and eventually enters Bear River Migratory Bird Refuge and the Great Salt Lake west of Brigham City, Utah.

The longitudinal profile of the river is steep near its headwaters but flattens quickly as it reaches the Wyoming border near Evanston. At Cokeville Meadows Refuge, the river gradient is about 2 feet per mile. The uplands to the east of the Bear River Valley constitute the divide between the Great Salt Lake and the Green River and Colorado River watershed. The uplands to the west of the Bear River Valley form the divide between the circuitous drainage of the Bear River and the direct drainage into the Great Salt Lake.

The Bear River Valley reaches its greatest width (about 3 miles) just north of the south border of Wyoming. Then the valley narrows to less than one-quarter-mile wide at Myers Narrows, about nine miles south of Evanston, and then to less than 100 yards wide at the narrows, north of Evanston. The Bear River Valley widens again to about 2 miles at Cokeville Meadows Refuge and then narrows again just north of the town of Cokeville, Wyoming, where it is less than one-quarter-mile wide.

Southwestern Wyoming, west of the Green River Basin, is characterized by north-trending mountain ranges, ridges, and valleys that represent diverse geological formations (Veatch 1907). The area under Cokeville Meadows Refuge includes complex folded and eastward-thrust rocks of Paleozoic, Mesozoic, and early Tertiary ages overlain by slightly deformed later Tertiary and Quaternary sediments. The north-south belt of mountains and overthrust faults is known as the "Overthrust Belt" Geologic Province of western Wyoming, southeastern Idaho, and northeastern Utah (Blackstone 1977). The Overthrust Belt is part of an extensive area of folding and faulting

that runs north–south from Canada to Mexico, also known as the Cordilleran Fold Belt (Ver Ploeg and DeBruin 1982). Additional detailed information on the geology of the refuge vicinity can be found in other sources such as Lines and Glass (1975), Rubey et al. (1980), Bradley (1936), Laabs et al. (2009), Reheis et al. (2005), Reheis et al. (2009).

The contemporary geomorphologic surfaces at Cokeville Meadows Refuge (Reheis et al. 2005) are primarily one- to two-mile-wide Holocene alluvial deposits from the Bear River flanked by younger-age alluvial fans and low terraces. The alluvial fill exceeds 185 feet in thickness in some areas of the Bear River Valley near Cokeville Meadows (Robinove et al. 1963). Alluvial fan deposits, which extend about two-thirds up the Bear River Valley in the Cokeville Meadows region, reach a thickness of 75 feet. Natural levees occur next to larger perennial tributary streams, and some older, partly buried or scoured, natural levees exist next to former abandoned channels of the Bear River. Other important geomorphic surfaces include active alluvial fans on the west side of the valley, older Pleistocene terraces and glacial outwash on the southeast side of the valley, Pleistocene sediment deposits, the alluvium of side slopes and small intermittent streams, and older terraces and alluvial fans. Drainage within the area is through many streams and creeks that flow directly into the Bear River or by infiltration into alluvial fans and terrace deposits next to the river floodplain.

Elevations on Cokeville Meadows Refuge range from about 6,500 feet above mean sea level on the bluffs at the south end, to about 6,170 feet on the north end where the Bear River exits the refuge. Topographic heterogeneity on the refuge is related to historical Bear River channel and tributary channel migrations, minor within-floodplain channels, floodplain scouring, and alluvial deposition. Significant topographic features include the many abandoned channels of the Bear River, old alluvial and glacial terraces, and alluvial fans.

Subsurface Minerals within the Refuge Boundary

The subsurface minerals that can be found within the approved acquisition boundary of the refuge include coal, phosphate, potash, sodium, oil, and gas.

Soils

Soil mapping for the Cokeville Meadows region of Lincoln County, Wyoming, is incomplete, and con-

temporary, detailed soil maps for the refuge are not available. Soil maps from the Bear River Valley immediately upstream of Cokeville Meadows Refuge in Rich County, Utah, and a preliminary interim soil map prepared by USDA Natural Resources Conservation Service for the Bear River Valley in Lincoln County provide general descriptions of soil types and their distribution. Clearly, about 12 major soil types or groups are present on, or next to, Cokeville Meadows Refuge. The arrangement of soils on the refuge is complex and reflects the many channel migration events across this floodplain, introduction of mixed-erosion sediments from surrounding Quaternary and Tertiary terraces, and alluvial deposition of Bear River Valley parent materials.

Most soils on the refuge are shallow, with thin veneers of loam, silt, and clay overlying deeper sands and gravels, and can generally be categorized by three broad groups. The largest geomorphic soil group occupies floodplains and low terraces and is of the Calciaquoll-Cryaquoll-Riverwash Association. This group is characterized by nearly level to strongly sloping (from 0- to 15-percent slopes) soils that are generally deep, variable in texture, and derived from alluvium. Test borings and wells show that the greatest thickness of the alluvium, including thin veneers of silt loams and underlying alluvial sands and gravel, is about 150 feet thick (Robinove et al. 1963). Silts that overlay gravel typically are less than 6 feet below the surface. Wader loam is made up of most soils immediately next to the active Bear River channel, and Dogie Creek sandy loam occupies natural levees along the Bear River channel. Floodplain soils that overlie former meander belts of the Bear River include Bear Lake silt loam, and Bereniceon silt loam. Abandoned channels and other meander belt depressions in the Bear River floodplain have clay or silt-clay soils overlying sands and gravels of former river channel bottoms.

The second soil group at Cokeville Meadows Refuge occurs on alluvial fans and high terraces on the edges of the Bear River floodplain. These soils are found on nearly level to moderately steep slopes (from 0- to 30-percent slopes) and are generally well-drained gravelly and cobble silty and sandy loams such as Nevka loam, and Duckree gravelly loams. Alluvial fan deposits may reach a thickness of 75 feet.

The third group is present on the foothills of the Overthrust Belt and is of the Calciorthrid-Haploxeroll-Torriorthent Association. Geologic overthrusting and the resulting mixed parent materials have produced variable soil textures and complex soil or land-form relationships.

Water Resources

Described below are Cokeville Meadows Refuge's hydrology, water quality, and water rights.

Hydrology

Waterflow into the Bear River comes from regional precipitation, snowmelt, and ground water discharge. The Smith's Fork River and the Sublette, Twin, Spring, Brunner, Muddy, and Coral Creeks are major tributaries to the Bear River near Cokeville Meadows Refuge. Water in the Bear River is fresh, but shallow depressions and larger lakes in the system can be highly saline. The Bear River at Cokeville Meadows Refuge has little gradient, channel slope is approximately 1.5–2 feet per mile. The flat relief and low stream gradient have caused the Bear River to often alter its course across the floodplain, which has created many abandoned river channels and entrenched meanders. Most of the refuge acquisition boundary is within the 100-year floodplain (figures 10 and 11).

Historically, the Bear River had a strongly unimodal discharge, or river stage pattern, with peak discharges above 400 cubic feet per second (cfs) in June and relatively sustained low discharges near 100 cfs from August through February. Water from the Bear River begins to enter many off-channel oxbows and depressions at about 300 cfs, and much of the floodplain is inundated at discharges of greater than 1,000 cfs. Consequently, historical flow data suggest overbank and backwater flooding from the Bear River into the Cokeville Meadows floodplain ecosystem has typically occurred for only short time periods in late May through mid-June in most years. While of short duration, these seasonal floods recharge floodplain wetlands to their highest levels in spring. Thereafter wetlands gradually dry from evapotranspiration to low maintenance levels in the winter.

Besides the strong seasonal pattern of river discharge, stage data from the Bear River below Pixley Dam, near Cokeville, Wyoming, show a long-term pattern of peak discharges about every 12–15 years when the river exceeds 1,500 cfs. In contrast, intervening dry years did not have river discharges greater than 500 cfs. During the 60-year record below Pixley Dam, the Bear River exceeded 1,500 cfs for 9 years and was below 500 cfs for 15 years. This suggests that there is a highly dynamic flooding environment for floodplain wetlands in the Cokeville region. Years with extensive overbank flooding punctuate years with more regular, moderate flows and frequent dry years (Wyoming Water Development Commission 2001).



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Yellow-headed Blackbird

The central division of the Bear River in Wyoming, including Cokeville Meadows Refuge, has about 500,000 acre-feet of waterflow in wet years, about 190,000 acre-feet in average years and essentially no flow in extremely dry years. In average and wet years, available waterflow occurs during the nonirrigation season (August–March) on both the Smith's Fork and Bear River mainstem channels. The long-term, alternating wet–dry pattern of waterflow into the Bear River and the related, variable annual recharge of floodplain wetlands probably caused long-term, regularly fluctuating patterns of wetness and dryness in these wetlands at about 10- to 15-year intervals.

Ground water in the refuge area is present in the Bear River Valley alluvium, alluvial fan deposits, and in older, underlying geologic formations. The alluvial aquifer underlying the refuge is bounded laterally and vertically by relatively impermeable shale (Glover 1990). This shale layer effectively prevents ground water movement between the alluvial aquifer and other, deeper formations. The potentiometric surface of the alluvial aquifer, a hypothetical surface representing the level to which ground water would rise if not trapped in a confined aquifer, shows that water enters the aquifer as underflow from the Bear River at the upstream part of refuge and then this water discharges downstream into the Bear River (Berry 1955). A second source of water recharge into

the alluvium is leakage from tributary streams. Generally, ground water levels in the alluvium mirror seasonal precipitation and Bear River discharge patterns.

Alluvial fan deposits also yield large quantities of water where they overlie the alluvium, but the amount of ground water gradually decreases away from the Bear River as the saturated thickness decreases (Berry 1955). The recharge for alluvial fans is derived mainly from infiltrations of surface runoff. Several older geologic formations that underlie the area, including Madison limestone, the Amsden Formation, Tensleep sandstone, the Bear River Formation, and the Wasatch Formation, also provide moderate quantities of ground water to wells. Water from these formations is generally under artesian head and often moves to the land surface as low elevations dip from their outcrop areas. Up to 100 gallons of water per minute occur in artesian wells derived from the Madison limestone and Tensleep sandstone outcrops.

Transpiration, primarily from willows, persistent emergent wetland plants, and wet meadow grasses and sedges or rushes that obtain water directly from the water table, is a significant type of ground water discharge during the summer (Glover 1990). The amount of water that discharges as transpiration depends on the consumptive needs of various plant species and the depth to water. Transpiration is higher when the water table is high and at the land surface (such as in wetter years) and decreases as depth to water increases.

Ground water from the northern part of the Bear River Valley, including the Cokeville Meadows area, is of a calcium bicarbonate type, but constituents vary by geological source (Robinove et al. 1963). Total mineral content of alluvial ground water is 285–510 parts per million dissolved solids. Ground water seepage from the Smith's Fork River influences local ground water quality and clearly reduces local sodium and chloride levels. Generally, wells tapping alluvium up gradient and away from return flow into the Bear River have water that is lower in dissolved solids and with lower sodium and chloride content than sites close to the river channel. Terrace deposits and alluvial fans contain magnesium-calcium bicarbonate-type ground water with moderate amounts of sulfate. Deeper artesian ground water contains mixed-type water, predominantly sodium-calcium sulfate and bicarbonate types.

Water Quality

Surface water quality in the Bear River and floodplain wetlands varies because of human activities and natural processes and is affected by the water's source and drainage. The area is underlain by Pre-

cambrian metamorphic rocks on the north slopes of the Uinta Mountains of northeastern Utah and underlain by Tertiary formations and lined by Tertiary and Cretaceous rocks in Wyoming. Seasonal fluctuations in the discharge of the Bear River are accompanied by relatively minor changes in the total mineral content of the water; the effects of high flows in spring include mainly the dilution of major constituents.

Bear River water generally has a progressive increase in mineral content as it approaches the Beckwith and Quin Dam (BQ Dam) and then decreases in mineral content as it flows downstream from the BQ Dam to Cokeville, Wyoming. Part of this latter decrease in mineral content is due to dilution by lower-mineral water entering the Bear River from the Smith's Fork River (Robinove et al. 1963). In the central watershed, water quality is changed by excess suspended sediments, high levels of nutrients, and high water temperatures along some reaches (Bear River Watershed Information System 2007). Nutrient and sediment loads of the Bear River progressively decrease through the central region until the river reaches the confluence with Smith's Fork (Bear River Watershed Information System 2007). Inflow from Smith's Fork has especially high nutrient and sediment loads during the summer.

The upper part of the Smith's Fork has relatively good water quality. However, as this tributary travels through lower-gradient land, water quality



White-faced Ibis

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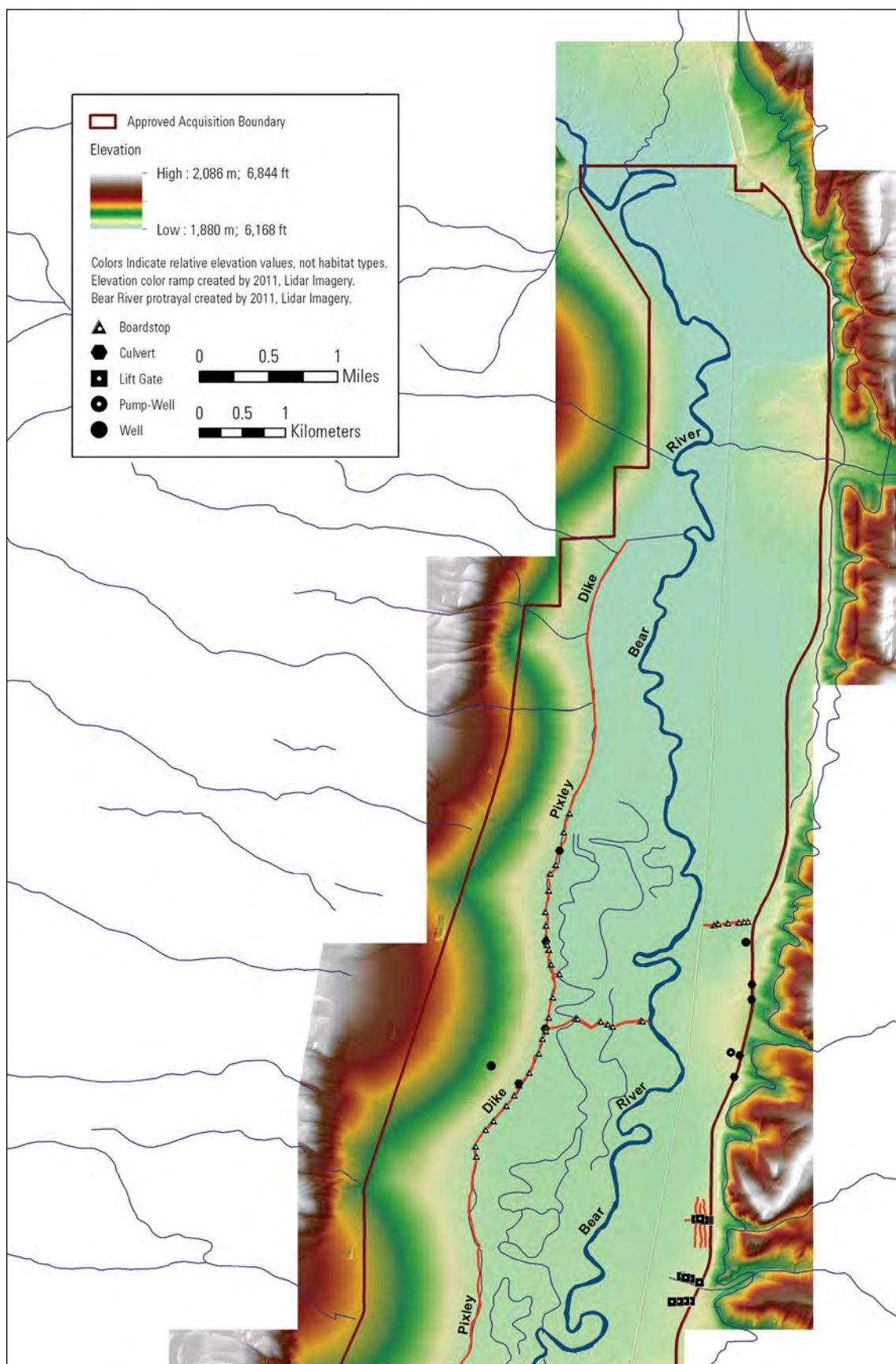


Figure 10. Light detection and ranging-generated (LIDAR) topography—with hydrology and water control structures—of the Cokeville Meadows National Wildlife Refuge, Wyoming (North).

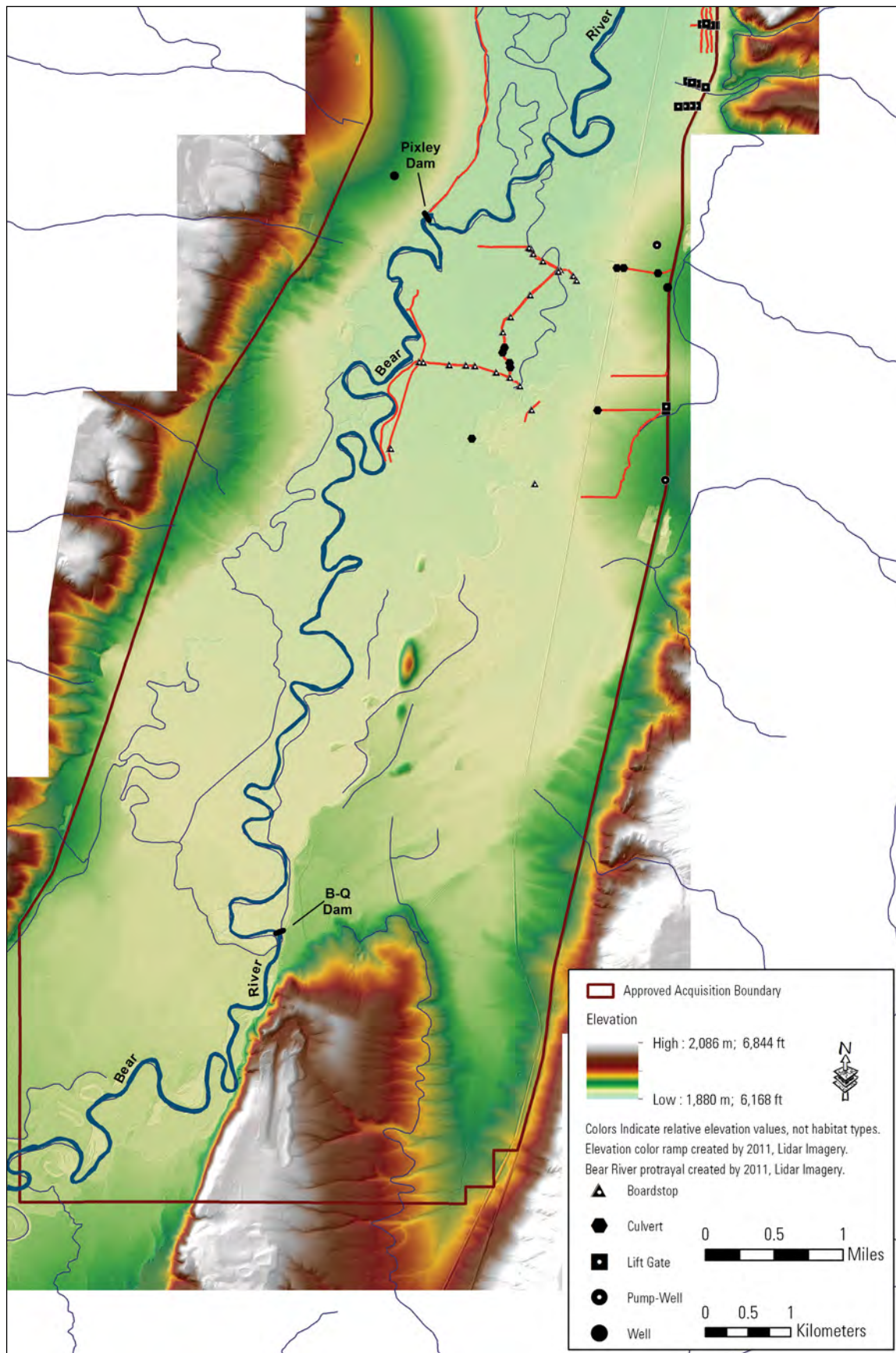


Figure 11. Light detection and ranging-generated (LIDAR) topography—with hydrology and water control structures—of the Cokeville Meadows National Wildlife Refuge, Wyoming (South).

decreases due to a variety of sources. At the confluence of Smith's Fork with the Bear River, water quality is changed by sediments. Bank erosion is the main identified contributor. WFGD established the Smith's Fork Steering Committee in 2004 to attempt to reduce high-sediment loads, increase bank stability, and improve wildlife habitat through best management practices, changing grazing practices, and controlling seasonal burns.

Agrichemicals pose another water quality issue. Elevated levels of phosphorus and nitrogen degrade water quality, but this issue occurs primarily downstream of the refuge and is beyond the scope of this CCP. Now, sediments are the greatest concern on the refuge and for adjacent upstream and downstream reaches of the Bear River. Sediment loads increase because of construction, grazing, and natural instream erosion. Irrigation return flows to the Bear River may also contribute to water quality issues, including nitrogen concentrations from animal wastes. Streambank stabilization and keeping livestock at controlled watering points may address the larger issues (Krueger 1994; Winward 1994).

Water Rights

The Bear River Commission was formed by compact in 1958 to allocate water use throughout the watershed. Major uses include agriculture, irrigation, power generation, recreation, and municipal and industrial needs. The Bear River's average annual inflow to the Great Salt Lake is nearly 1.2 million acre feet, and, with this plentiful water supply, the Bear River Basin is one of the few areas remaining in the State of Utah with a substantial amount of developable water. Water rights for the Bear River are fully allocated, but not fully developed (table 4).

Air Quality

Air quality problems in Wyoming are usually related to urban areas in mountain valleys or to river valleys that are sensitive to temperature inversions. Particulate matter and carbon monoxide have the greatest adverse affects on Wyoming's air quality. Particulate matter is a measure of tiny liquid or solid

Table 4. Water rights summary for Cokeville Meadows National Wildlife Refuge, Wyoming.

<i>Permit number, proof number</i>	<i>Priority date</i>	<i>Volume rate, cubic feet per second</i>	<i>Volume, gallons per minute</i>	<i>Use</i>	<i>Irrigation acres</i>	<i>Source</i>
Permit #12453 Proof 16322	6/1/1914	1.22		Irrigation	80	Ellen Reservoir
Permit #195333 Beckwith No. 1 Enl. and Replacement	12/22/2010		2000	Irrigation	290.67	Ground water (Pending 2,000 gallons per minute)
Permit #195332 Thornock Bros No. 1 Replacement Well	12/22/2010		2000	Irrigation	284.16	Ground water (Pending 2,000 gallons per minute)
U.W. 42138 Cornia No. 3 Well	4/8/1977		1300	Irrigation	347.76	Ground water
Permit 9120 Proof 23297 (44A)	6/9/1909	4.97		Domestic, Irrigation	348	Smith's Fork Irrigation District
Permit 9120 Proof 20756 (15, a)	6/9/1909	0.29		Irrigation	39.76	Smith's Fork Irrigation District
Permit 9120 Proof 15155 (15, A)	6/9/1909	0.69		Irrigation, Stock	48.6	Smith's Fork Irrigation District
U.W. 15162 Corina No. 2 Well	8/14/1972		25	Domestic or Stock		Ground water
Permit 295E Proof 9993 (41, a)	5/31/1897	7.34		Domestic, Stock		Smith's Fork Irrigation District
Permit 9120 Proof 23411	6/9/1909	2.2		Irrigation, Domestic	514.66	Smith's Fork Irrigation District

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Proof 4451E Tanner Supply Ditch Enl.	4/18/1925	0.38		Irrigation	27.1	Antelope Creek
U.W. 74218 Buckly No. 4 Enl. Well	11/9/1984		450	Irriga- tion*		Ground water (450 gallons per minute Supplemental Supply to lands under U.W. 60699)
U.W. 59625 Buckly No. 3 Well	7/1/1982		25	Domestic, Stock		Ground water
U.W. 60689 Buckly No. 4 Well	2/8/1982		1000	Irriga- tion*	158.62	Ground water (Supplemental supply under 9120 and 4451E 1000GPM)
Permit 9120 Proof 23297 (Etch- every Sheep CO)	6/9/1909	0.4		Irrigation, Domestic	27.55	Smith's Fork Irrigation District
Permit 9120 Proof 23412 (20A, 30)	6/9/1909	0.93		Irriga- tion*	65.21	Smith's Fork Irrigation District (36.67 Acres irrigated by supplemental supply through Pixley)
Permit 9120 Proof 15155 (20a, 30)	6/9/1909		0.75	Irrigation, Stock	52.6	Smith's Fork Irrigation District
Permit 9120 Proof 20756 (20A, 30)	6/9/1909	1.14		Irrigation	80.45	Smith's Fork Irrigation District
Territorial Permit Proof 8617 (19, a-c)	5/31/1878	1.6		Irrigation	787	Bear River
Territorial Permit Proof 8619	12/31/1879	2.29		Irrigation	160	Bear River (Service has part of total permit)
Territorial Permit 8621 (19, a-c)	12/31/1880	0.43		Irrigation	30	Bear River (Service has part of total permit)
Territorial Permit 8634 (19, a-c)	12/31/1881	2.37		Irrigation	166	Bear River (Service has part of total permit)
U.W. 57459 Thornock No. 3 Well	4/14/1981		1200	Irrigation, Stock	212.6	Ground water
U.W. 73966 Thornock No. 3 Enl. Well	6/9/1982		200	Irrigation	158.62	Ground water
Permit 3264 Proof 8722	6/12/1901	1.14		Irrigation	80	Bear River
Territorial Permit Proof 8883	12/31/1881	0.28		Irrigation	20	North Lake Spring Creek

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Permit 9120 Proof 16241	6/9/1909	5.49		Irrigation	384	Smith's Fork Irrigation District
Permit 9120 Proof 23412	6/9/1909	0.08		Irrigation*	5.98	Smith's Fork Irrigation District (Supplemental supply under Terr through Pixley Ditch)
Territorial Permit Proof 8918	12/18/1908	Not quantified		Stock*, Domestic*, Irrigation*		Tributary of Bear River (supplemental supply for BQ Dam East Use: S, D, I)
Territorial Permit Proof #8617	5/31/1878	0.68		Irrigation	48	Bear River (Plus Sucker Springs)
Territorial Permit Proof #8634 (44A)	12/31/1881	0.29		Irrigation	20	Bear River
U.W. 41237 Bartek No. 1 Well	7/20/1977		718	Irrigation	352	Ground water
Permit 9120 Proof #23297 (20A, 30)	6/9/1909	0.01		Irrigation*	6.91	Smith's Fork Irrigation District (Supplemental supply under Leeds Ditch 1888 Priority and 1301 Enl.
Permit 9120 Proof #20756 (44A)	6/9/1909	3.38		Irrigation, Domestic	236	Smith's Fork Irrigation District
Permit 1761E Proof 8782	8/3/1907	0.08		Irrigation	6	Bear River
Territorial Permit Proof #8621 (Etch- everry Sheep CO)	12/31/1880	2.35		Irrigation	165	Bear River
Territorial Permit Proof #8634 (Etch- everry Sheep CO)	12/31/1881	0.58		Irrigation	41	Bear River
Territorial Permit Proof #8622	12/31/1880	11		Irrigation	766	Bear River
U.W. 308 Etch No. 1 Well	7/24/1959		1440	Irrigation	154.25	Ground water
Permit 295E Proof 9993 (Etch- everry Sheep CO)	5/31/1887	0.37		Stock, Domestic		Smith's Fork Irrigation District
Permit 2066E Proof #14118	3/8/1909	0.4		Irrigation	28	Pine Creek
Permit 9120 Proof #23410	6/9/1909	0.01		Irrigation, Domestic	0.75	Smith's Fork Irrigation District

Table 4. Water rights summary for Cokeville Meadows National Wildlife Refuge, Wyoming.

Permit number, proof number	Priority date	Volume rate, cubic feet per second	Volume, gallons per minute	Use	Irrigation acres	Source
Permit 2065E Proof #14114	3/6/1909	0.4		Irrigation	28	Smith's Fork Irrigation District

**Title 41-3-113 Wyoming Statute for Supplemental Supply Water Rights: A supplemental supply water right is defined as a permit or certificate of appropriation for the diversion, from a stream, of water from a new source of supply for application to lands for which an appropriation of water from a primary source already exists. Such supplemental supply permits or certificates of appropriation may be allowed by the State engineer or the State board of control under such regulations or conditions as he or it may prescribe. The use and administration of presently existing rights for supplemental supply appropriations or rights for supplemental supply appropriations hereafter acquired shall hereafter be made upon the express condition that the total amount of water to be diverted at any one (1) time both under a primary appropriation of water and a supplemental supply appropriation shall not be in excess of one (1) cubic foot of water per second of time for each seventy (70) acre tract so irrigated, except that when the right to divert water under the provisions of W.S. 41-4-317 through 41-4-324, is permitted the total amount of surplus water to be diverted at any one (1) time both under a primary appropriation of water and a supplemental supply appropriation shall not be in excess of one (1) cubic foot of water per second for each seventy (70) acre tract so irrigated. Nothing herein shall be construed to apply to water stored under a reservoir permit. (Wyoming Legislative Services Office. [No date]).*

particles in the air that may be breathed into the lungs. In the area of the refuge, carbon from automobiles, including all-terrain vehicles and snowmobiles, and diesel engines; soot from slash burning, forest fires, fireplaces, and wood stoves; and dust associated with windblown sand and dirt from roadways and fields may all contribute to particulate matter. The major sources of particulate matter are dust from vehicles traveling on unpaved roads and forest fire smoke.

The refuge is in a designated Class I air quality area as defined under the Clean Air Act of 1977. Air quality here is considered good, with no nearby manufacturing sites or major air pollution sources. Throughout the year, occasional widespread regional smoke from large-scale forest fires located to the west and annual agricultural burning that occurs in Idaho reduce visibility at the refuge. The small particles and aerosols resulting from these fires are carried long distances in the air and cause haze.



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Sandhill Cranes

3.2 Biological Resources

The wide range of altitudes in the Bear River watershed allows for diverse habitats. Grasslands and shrublands dominate the flats and lowlands, while pinion-juniper woodlands and pine forests are found on higher slopes. Big sagebrush is common on much of the landscape, although other shrubs, such as rabbitbrush, saltbush, and greasewood, may dominate some areas. Lower elevations are mostly private land, with most of the pasturelands in the wide valleys used for agriculture and grazing. Bear River water is used extensively to irrigate alfalfa, pastureland, and small grain crops.

The Bear River provides important wildlife corridors for species migration in the western United States. The small, pristine mountain streams in the forested headwaters are ideal breeding habitat for the Bonneville cutthroat trout and leatherside chub, important native species. Many species, such as elk, black bear, pika, and marmots use these high-elevation forests and snow-covered mountain slopes.

In the course of its 500-mile journey, the Bear River passes through three national wildlife refuges: Cokeville Meadows Refuge, Bear Lake Refuge, and Bear River Migratory Bird Refuge. The primary routes of migratory birds following the Pacific and central flyways combine in the Bear River watershed. The refuges and adjacent areas provide essential habitat for many species of waterfowl and wading, shore, and upland birds that migrate through on their way to and from Canadian and Alaskan interior and coastal wetlands.

More than 200 bird species have been documented within the watershed, half are closely associated with wetlands. Many marsh and shorebirds, including white-faced ibis, snowy egret, long-billed curlew, black tern, great blue heron, American bittern, black-crowned night-heron, trumpeter swan, and sandhill crane, along with upland birds, such as the greater sage-grouse and Columbian sharp-tailed grouse, can be found throughout the watershed.

Besides bird species, several mammals are dependent on the blocks of intact habitat and the key migration linkages between these areas. Elk, mule deer, moose, and pronghorn depend on key wintering areas and migration corridors throughout the watershed.

This section describes the specific wet meadows, uplands, riparian and river habitats (figure 12) and wildlife found on the refuge.

Wet Meadow Habitat

Wet meadows include a variety of wetlands, which are defined as lands where soil is saturated by water at least periodically or is covered by water (Cowardin et al. 1979). The degree of saturation determines the types of plants and animals that live in the soil or on the surface. Furthermore, wetlands can be considered to be transitional areas between aquatic habitats and dry upland habitats.

Several types of wetlands occur on Cokeville Meadows Refuge: (1) saline meadow; (2) wet meadow, consisting of native or tame grasses; (3) tall emergent wetland; and (4) open water, including managed impoundments that have shallow standing water for most of the growing season, small stock ponds, and irrigation canals.

Saline Meadow

Because of the geologic origins of some soils, salts tend to percolate to their surfaces when they are saturated with water. Only salt-tolerant plants may survive in saturated saline or alkali soils. Saline meadows are dominated by salt grass, greasewood, alkali sacaton, alkali cordgrass, and other salt-tolerant species.



Tom Koerner / FWS

Many of the wetlands on Cokeville Meadows Refuge flood seasonally. Local snowmelt initially fills the wetlands followed by snow at higher elevations that melts and eventually raises the Bear River.

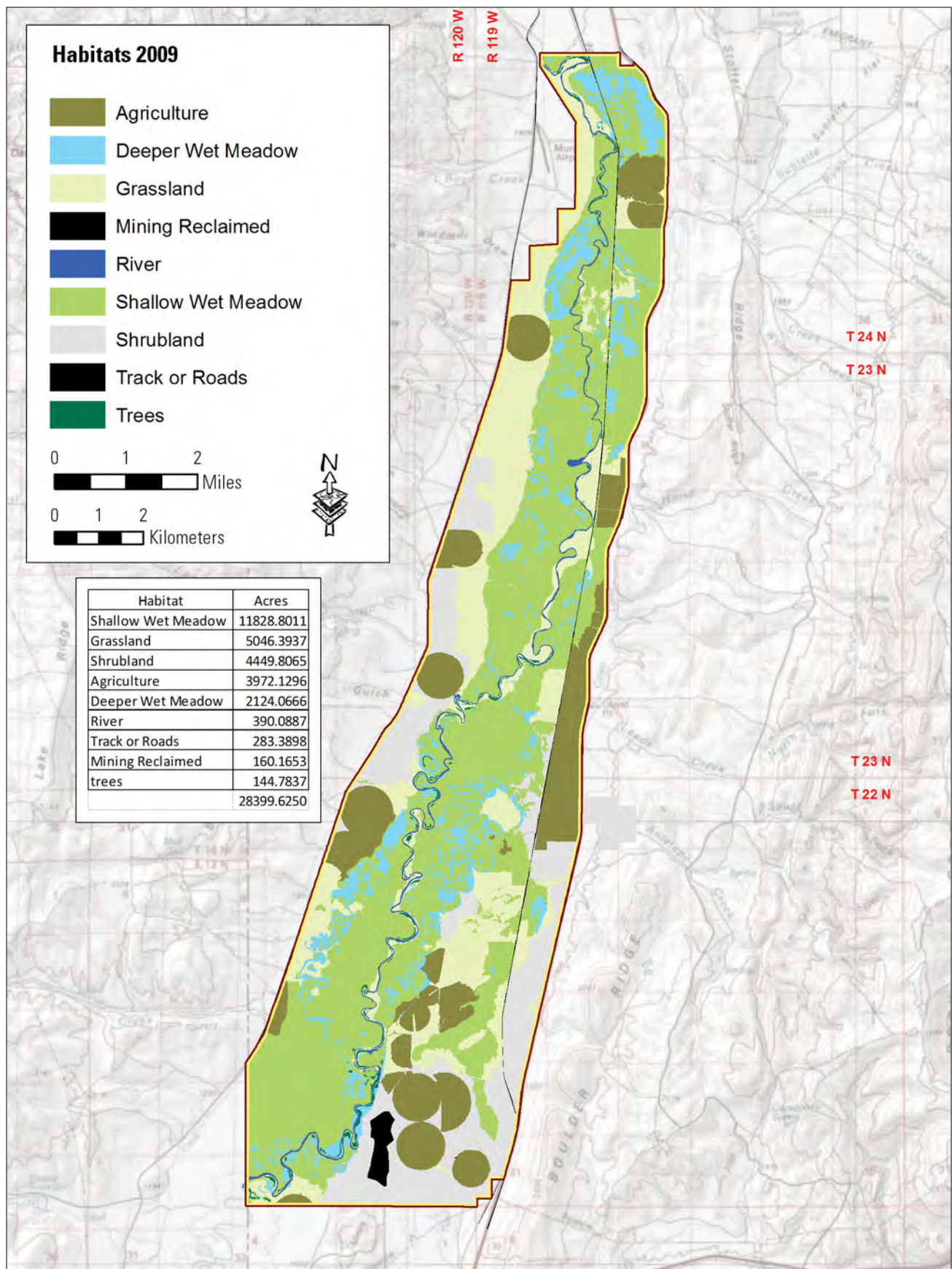


Figure 12. Existing habitats within the approved acquisition boundary of the Cokeville Meadows National Wildlife Refuge, Wyoming.



Tom Koerner / FWS

As snow on nearby mountains melts, the Bear River rises and water diverts into many of the refuge's wetlands.

Wet Meadow

Wet meadows may have shallow standing water of less than 6 inches dominated by meadow foxtail (Garrison grass is a cultivar), wire rush, and sedges.

Tall Emergent Wetland

Tall emergent wetlands occur during the primary growing season from late spring through summer and always have shallow standing water of less than 12 inches dominated by hardstem bulrush and cattails.

Open Water

Open water plant communities include rooted, submerged aquatic plants such as pondweed and floating plants such as duckweed.

Typically, wetlands support hydrophytes (water-loving plants) and hydric soils and hold water for most of the growing season (Cowardin et al. 1979). In predominantly arid southwestern Wyoming, water is a limiting factor for many species, and is highly attractive for most species. For many plant and animals, the availability of unbound water is essential. Below are listed the obligate emergent wetland and wet meadow bird species.

Obligate emergent wetland bird species:

- trumpeter swan
- Canada goose
- redhead

- greater sandhill crane
- white-faced ibis
- Forster's tern
- black tern
- common yellowthroat (warbler)

Obligate wet meadow bird species:

- American bittern
- sora (rail)

White-tailed deer, elk, striped skunks, deer mice, meadow voles, muskrats, northern leopard frogs, and wandering garter snakes are among the more common nonbird wildlife species found on the refuge's wet meadow and wetland habitats.

Results of the refuge's HGM study show that human-caused changes in the local hydrology have altered the nature of wet meadow habitats on the refuge (Heitmeyer et al. 2012). Since refuge establishment, we have continued to flood wet meadows every year in a way similar to that used by the pioneer farmers and ranchers who developed the valley's irrigation system in the early 20th century. Thus, the natural pulses of flooding and drying and drought cycles have been removed from the wet meadows for over 100 years. Our irrigation practices and those of earlier landowners resulted in extended hydroperiods. The meadows are flooded longer and deeper than they were under natural conditions.

While the economic use of these lands for haying and grazing has resulted in excellent habitat for a variety of migratory birds and other wildlife, it has

also caused potentially negative changes, including the loss of native vegetation types and habitat diversity. Much of the meadows are covered with a near monoculture of creeping meadow foxtail (*Alopecurus arundinaceus*). As a result, native sedge, rush, and bulrush communities have declined.

Upland Habitat

Sagebrush-dominated habitats form one of the largest ecosystems in North America (Gleason and Cronquist 1964; Trimble 1999). In North America, sagebrush or shrub-steppe habitats are bounded on the west by the Sierra Nevada and the Cascade Range and on the east by the Rocky Mountains and the Colorado Plateau. These habitats run as far north as the Okanagan Valley, British Columbia, and south to almost the Grand Canyon and the Colorado River. These habitats are dominant in Utah, Nevada, western Colorado, southwestern Wyoming, southern Idaho, eastern California, Oregon, and Washington.

Three major characteristics generally describe shrub-steppe habitats: (1) the great expanse in area occupied contiguously by a single plant or structural type; (2) the sharpness of the boundary, or ecotone, between adjacent habitat types; and (3) the occurrence of a single dominant species, like sagebrush, or, alternatively, the occurrence of few codominant species (Gleason and Cronquist 1964; Trimble 1999).

In western States, shrub-steppe has been seriously degraded or completely removed through agricultural conversion, overgrazing by domestic livestock, invasion by exotic plants, expansion of pinion-juniper (*Pinus* spp.–*Juniperus* spp.), uncharacteristic wildfires, and habitat fragmentation. In fact, the changes that occurred since Euro-Americans arrived in the early 1800s were so rapid that little is known about the original landscape.

Wildlife associated with shrub-steppe habitats may also be characterized by a limited number of species (Paige and Ritter 1999; Nicholoff 2003), and some of these are experiencing population declines. The sagebrush-obligate greater sage-grouse is of significant conservation concern throughout its range. The species is a candidate for listing under the ESA, and efforts to restore shrub-steppe habitat and grouse numbers are now the focus of multiple Federal and State agencies throughout western States and Provinces. Other obligate birds of shrub-steppe habitats, including many long-distance migrants, (Rich et al. 2005) have also shown significant population declines in recent years, including the sage thrasher, Brewer's sparrow, and sage sparrow.

Other species are considered shrub-steppe obligates part of the time, as they are found in habitats such as grasslands. Many of these species are also declining in population, including the short-eared owl and the vesper sparrow. Even the widely distributed Western meadowlark has shown declines in recent years. Below are listed the obligate and semiobligate



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Water can be deep and semipermanent flooding prevalent in old river channels and depressions. This allows submerged aquatic vegetation such as bladderwort to thrive.



Tom Koerner / FWS

Emergents such as Baltic rush, native sedges, and creeping foxtail grow in large, seasonally flooded wetlands during the summer.

grassland and shrub-steppe nesting bird species occurring at Cokeville Meadows Refuge.

Obligate grassland community bird species:

- short-eared owl
- mountain plover
- horned lark
- western meadowlark

Obligate sagebrush-steppe (Sagebrush-dominated) community bird species:

- greater sage-grouse
- sage thrasher
- Brewer's sparrow
- sage sparrow

Semiobligate sagebrush-steppe (Sagebrush-dominated) community bird species:

- ferruginous hawk
- golden eagle
- prairie falcon
- mourning dove
- western burrowing owl
- common nighthawk
- Brewer's blackbird

Pronghorn, mule deer, western jumping mice, Wyoming ground squirrels, black-tailed jackrabbit, desert cottontails, coyotes, northern sagebrush lizards, and Great Basin gopher snakes are among the

more common nonbird wildlife species found on the refuge's uplands habitat

Riparian and River Habitats

Riparian habitats compose less than 1 percent of the total area of the Wyoming Basin, and are important to regional biological diversity. Riparian zones can vary considerably in size and plant composition because of the many combinations that can be created between water resources and the physical characteristics of a site, such as gradient, aspect, topography, soil types, water quality, timing and period of water availability, elevation, and plant community.

Riparian Corridors

Several characteristics set the Bear River riparian corridor apart from its surrounding shrub-steppe habitat: (1) a well-defined moist-soil or wet habitat-type boundary, typically linear and parallel with the river; (2) a small size relative to the overall valley; (3) greater productivity in terms of biomass, both plant and wildlife; and (4) greater biodiversity. Riparian habitats are essential for many native wildlife species, especially migratory birds (Nicholoff 2003) and are generally less resistant to human disturbances than other habitat types and sensitive to channel incision (Germanoski and Miller 2004).

Listed below are the obligate riparian corridor bird species found at Cokeville Meadows Refuge.

Obligate riparian corridor bird species:

- western wood peewee
- yellow warbler
- common yellowthroat
- willow flycatcher
- song sparrow

Semiobligate riparian corridor bird species:

- yellow-billed cuckoo
- MacGillivray's warbler
- black-billed cuckoo

Raccoons, red foxes, moose, long-tailed weasels, North American porcupines, American beavers, Valley garter snakes, and tiger salamanders are among the more common nonbird wildlife species found on the refuge's riparian habitat.

Wetland Conditions

Wetland acreages in Wyoming have declined in recent years because of agricultural conversion and urbanization (figure 13). Agricultural diversions, initially developed to remove soil salts and increase hay meadow production, have enhanced some wetlands along the central Bear River Basin. The Bear River wetlands are among the most productive and diverse bird habitats in Wyoming (USGS 1996).

However, since the establishment of Cokeville Meadows Refuge in 1993, subtle changes in land use have occurred. There has been a shift from gravity flow flood irrigation to mechanical pump-driven sprinklers, which has dropped the water table in the Bear River floodplain (Heitmeyer et al. 2012). A lack of proactive wildlife management actions has affected vegetation types, and conveyance systems deteriorated, which affected wildlife use of the area. The initial refuge focal species, particularly Canada geese, redhead, canvasback, white-faced ibis, American bittern, and terns now range farther and nest in more favorable habitats. Field studies are ongoing, but preliminary results show that American bittern and cinnamon teal numbers have increased substantially since 1993. Nesting pairs of Canada goose, redhead, white-faced ibis, and terns have declined on the refuge, but they nest on adjacent lands and into Utah.

The Thomas Fork and Smith's Fork, tributaries to the Bear River, and the Bear River reach between them provide ideal habitat for the Bonneville cutthroat trout (Behnke 1992, Baxter and Stone 1995). The most genetically pure strain of Bonneville cut-

throat trout within its ranges is found here. The Bear River links these tributary populations, resulting in what is likely the last connected large-river habitat available to Bonneville cutthroat trout. Habitat loss, migration barriers, and proposed reservoir development on Smith's Fork threaten the native Bonneville cutthroat populations in the central watershed of the Bear River Basin.

Trout Unlimited is involved in supporting and restoring migration corridors for the fish in Thomas Fork and Smith's Fork, and WGFD completed fishery habitat improvements on the headwaters of Thomas Fork as part of the Bonneville Cutthroat Trout Conservation Strategy (Bear Lake Regional Commission 2000, Trout Unlimited 2005). Besides Bonneville cutthroat trout, several native nongame fish of conservation concern also inhabit the Bear River and its tributaries. These include bluehead sucker, western silvery minnow, and the finescale dace.

There are a large number of carp in the river. When water is diverted into the wet meadows, carp make their way there. Carp can swim in the meadows where there is as little as 3 to 4 inches of water. Carp affect native species of fish and are not desirable on the refuge; however, there are not any well-known ways to control this population. Some members of the public expressed interest in harvesting carp with archery equipment. Our refuge staff will address this request as a potential recreational opportunity in a future fishing plan.

Haying, Grazing, and Prescribed Fire

Haying and rotational grazing of refuge habitats is conducted in the summer and fall every year. Past management techniques have degraded some habitat types, particularly woody riparian communities.

Prescribed fire has not yet been used on the refuge. If allowed, it would be a new tool in the habitat management toolbox and not a replacement for other treatment options.

Threatened and Endangered Species

No federally listed threatened or endangered species are known to occur at Cokeville Meadows Refuge. However, one listed plant may occur in the area and several candidate species occur, or may occur, that warrant our attention.

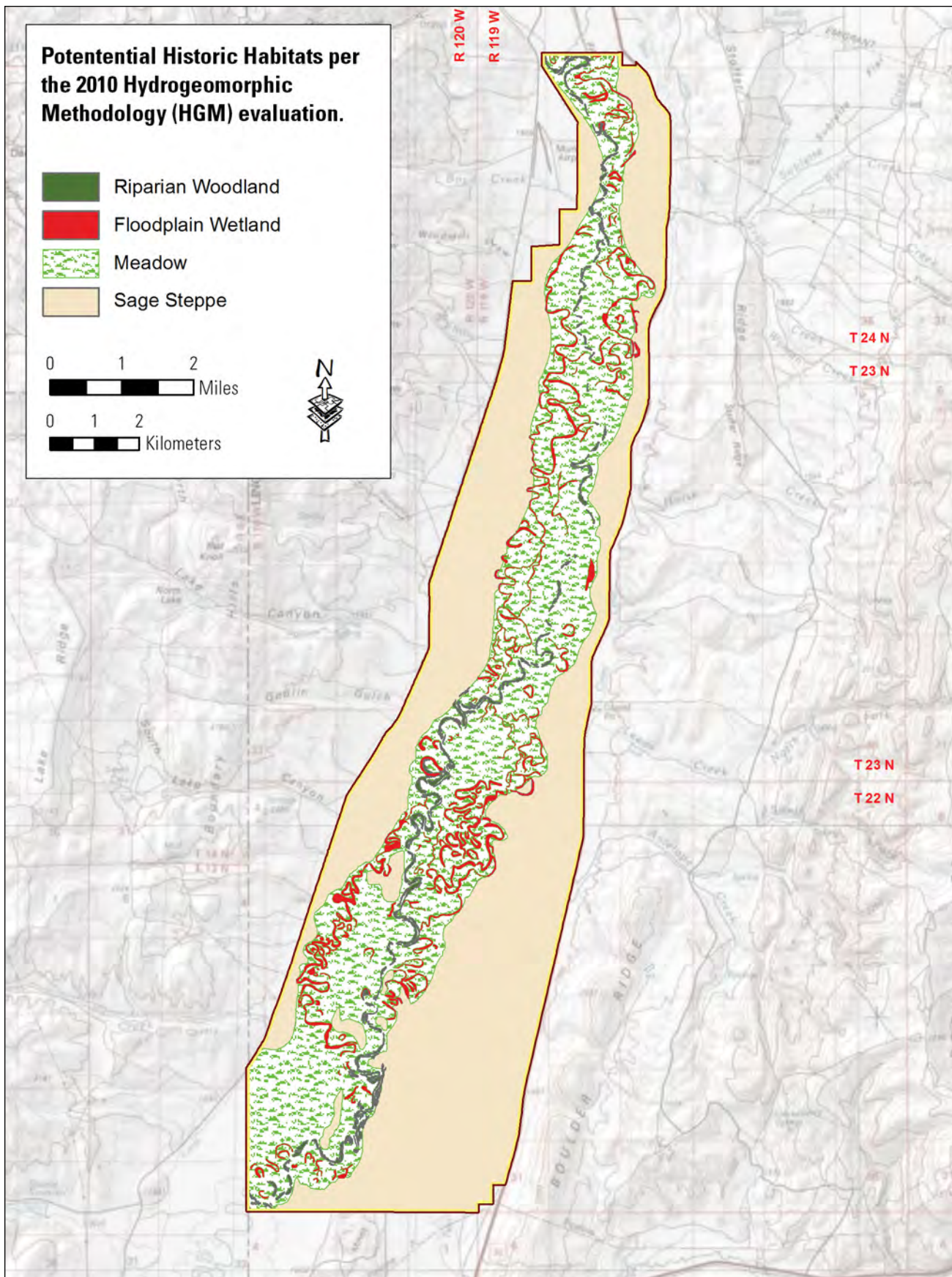


Figure 13. Potential historical habitats per the 2010 hydrogeomorphic method evaluation of the Cokeville Meadows National Wildlife Refuge, Wyoming.

Ute Ladies'-tresses Orchid

Ute ladies'-tresses orchid is federally listed as a threatened species under the ESA.

Cokeville Meadows Refuge lies within the range of the Ute ladies'-tresses orchid. This is a perennial orchid, 8- to 20-inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. This orchid normally blooms from late July through August. However, it may bloom in early July or still be in flower as late as early October, depending on climatic conditions. It is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet, although no known populations in Wyoming occur above 5,500 feet. Soils in which this orchid has been found typically range from fine silt or sand to gravels and cobbles, as well as highly organic and peaty soil types. It is not found in heavy or tight clay soils or in extremely saline or alkaline soils. Ute ladies'-tresses typically occurs in small, scattered groups found primarily in areas where vegetation is relatively open.

Because this orchid species appears to take 5 to 10 years to reach reproductive maturity, reproductively mature plants do not flower every year, and the refuge has not been specifically surveyed for its presence, it is unknown if this species exists within the boundary of the refuge.

Yellow-billed Cuckoo

Yellow-billed cuckoo is a candidate for Federal listing. The distinct population segment of the yellow-billed cuckoo west of the Continental Divide is a candidate for listing under the ESA (66 FR 143, 25 July 2001). In Wyoming, the yellow-billed cuckoo is dependent on large areas of woody, riparian vegetation that combine a dense shrubby understory for nesting and a cottonwood overstory for foraging. Destruction, degradation, and fragmentation of wooded, riparian habitats are continuing threats to yellow-billed cuckoos in Wyoming. Additionally, project actions to control outbreaks of caterpillars, cicadas, or grasshoppers and the general use of insecticides in, or next to, riparian areas may negatively affect yellow-billed cuckoos. Surveys to find the presence of yellow-billed cuckoos are difficult because of the secretive nature of the species and the variability in the timing of nesting. None have been sighted or documented on the refuge.

Greater Sage-grouse

Greater sage-grouse is a candidate for Federal listing. They are dependent on sagebrush habitats

year-round. Habitat loss and degradation, as well as the loss of population connectivity, have been identified as important factors contributing to the decline of greater sage-grouse populations across its range.

This species has been documented in upland sites next to the refuge's boundary, and there are historical records of this species using lands within the refuge's acquisition boundary.

Wyoming has adopted a "Greater Sage-grouse Core Area Protection" strategy to enhance conservation of the greater sage-grouse (State of Wyoming 2011). The recommendations of the State Sage-grouse Implementation Team and State of Wyoming's Core Area Protection strategy attempt to limit new development and harmful activities in areas with substantial sage-grouse populations. The northernmost portion of the Cokeville Meadows Refuge lies approximately 1 and a half miles due west of a designated sage-grouse core area.

Gray Wolf

Gray wolf is a species of concern in Wyoming and is federally listed under the ESA in other states. In Wyoming, gray wolves are no longer included on the Federal List of Endangered and Threatened Wildlife (50 CFR 17.11) and are no longer listed as a nonessential experimental population under the ESA (77 FR 55530; September 10, 2012). The gray wolf in Wyoming is now managed by the State under the Wyoming Gray Wolf Management plan. This management plan strives to support a gray wolf population in Wyoming of at least 150 individual wolves and 15 breeding pairs (at least 100 individuals and 10 breeding pairs outside of Yellowstone National Park and the Wind River Indian Reservation).

Section 4(g)(1) of the ESA requires us to monitor for at least 5 years, in cooperation with the States, the status of all recovered species that have subsequently been removed from the Federal List of Endangered and Threatened Wildlife. The primary goal of this monitoring is to make sure that the status of the recovered species does not deteriorate. If an unanticipated decline were detected, measures would be taken to avoid the need to relist the species as threatened or endangered.

Gray wolves follow the seasonal movements of big game and may occur in large ungulate migration, wintering, or birthing areas. While some project activities can affect gray wolves directly, changes to big game populations or herd movements can also affect their distribution, abundance, and survival.

Pygmy Rabbit

Pygmy rabbit is a species of concern. It is the smallest member of the rabbit family, and it occurs in

portions of many western states, including southwestern Wyoming. Pygmy rabbits are sagebrush-obligate species that are primarily found in areas with deep soils that support dense big sagebrush communities, often where other species of sagebrush and forbs also occur. The conversion of sagebrush grasslands, habitat fragmentation, fire, invasive plants, and overgrazing are considered potential threats to pygmy rabbits.

Planning measures that keep large tracts of suitable habitat and corridors to adjacent habitat will aid in the conservation of this species. In January 2008, our agency's division of ecological services started a status review to find out whether or not this species warrants listing under the ESA.

Mountain Plover

Mountain plover is a species of concern. It is a migratory, terrestrial shorebird averaging 8 inches (21 centimeters) in body length. Mountain plovers are light brown above and white below, but lack the contrasting band characteristic of other plovers. They feed on invertebrates, primarily beetles, crickets, and ants. These plovers arrive at their breeding grounds in the western Great Plains and Rocky Mountain States in the spring. Southbound migration is prolonged, starting in late June and continuing through October.

Suitable habitat for nesting mountain plovers includes grasslands, mixed-grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns.

White-tailed Prairie Dog

The white-tailed prairie dog is approximately 13- to 15-inches long and weighs 1 to 3 pounds. It is a small, stout rodent within the squirrel family. White-tailed prairie dogs have a short, white-tipped tail, large eyes, a blackish-brown cheek patch above and below each eye, and a tan-brown pelt. They typically inhabit moderately sloped grasslands, desert grasslands, and shrublands at altitudes ranging from 5,500 to 9,800 feet. While this rodent occurs over much of its historical range, colonies are more widely dispersed and population sizes have declined. This species inhabits areas across western and central Wyoming, northwest Colorado, northeastern Utah, and a small area in south-central Montana. Wyoming holds most of its range.

Prairie dogs serve as the primary prey species for the black-footed ferret and several raptors, including the golden eagle and ferruginous hawk. Prairie dog colonies and burrows also provide shelter or nest sites for species like the mountain plover and the bur-

rowing owl. In May 2008, we started a status review to find out whether this species warrants listing under the ESA.

Species of Concern

Besides species that are federally listed for protection under the ESA, there are others that are of special concern because of the threats they face and because they may fit one of the following categories:

- They are now or have recently been under review to find out whether they may warrant listing under the ESA in the future.
- They were recently delisted and there is still need for some protection to ensure the species' continued recovery.
- They are protected under Federal laws and warrant more attention.
- They are species that are considered likely to become candidates or proposed for listing in the near future and for which we have entered into conservation agreements.

Effective planning now can help the long-term conservation of these species and remove threats that may contribute to the future need for listing under the ESA.

The WGFD's wildlife action plan entitled "A Comprehensive Wildlife Conservation Strategy for Wyoming" provides a long-range conservation plan to conserve Wyoming's "Species of Greatest Conservation Need". The following are Species of Greatest Conservation Need for the area of Cokeville Meadows Refuge:

- Bonneville cutthroat trout
- bluehead sucker
- leatherside chub
- mountain sucker

All of these species are identified as endemic aquatic species of the Bear River watershed in Wyoming. Among the threats they face are changes in the quantity and quality of the river waters in which they dwell because of pollution and increased sedimentation and temperatures; diseases like whirling disease; stream channel modifications such as dredging, impoundments, channelization, erosion, tree and shade removal; competition from aggressive, nonnative species; and hybridization with nonnative species, which makes them less resilient.

Invasive Species

Invasive plants found on the refuge include creeping meadow foxtail. Noxious weeds from the Wyoming State Noxious Weed List found at Cokeville Meadows Refuge include perennial pepperweed and Canada thistle. The only known aquatic invasive species of concern currently found on the refuge is carp. Other aquatic invasive species of concern, such as zebra and quagga mussels, have not been found on the refuge.

Wildlife Disease, Crop Depredation, and Private Property Damage

The greatest wildlife disease concern on the refuge is the potential for brucella transmission to cattle when they commingle with elk. Diseases such as botulism and West Nile are also informally monitored, but do not have a history of prevalence, at the refuge.

Depredation concerns include damage to small grain crops by waterfowl and other migratory birds. In recent years, we have worked with permittees to plant a small grain crop on the refuge to help offset depredation and damage on nearby private lands.

3.3 Visitor Services, Human History, and Cultural Resources

This section details the various services provided to visitors at Cokeville Meadows Refuge and describes its human history and cultural resources.

Public Access

Since establishment, Cokeville Meadows Refuge has been closed to public access. In 2006, the refuge constructed a visitor contact station, an information kiosk, and a walking trail at the Netherly Slough along U.S. Highway 30 for public use. Environmental education, interpretation, wildlife observation, and photography are compatible uses that are allowed at this site on the refuge. No other public uses are authorized without a special use permit.

Private land issues affect access, which is allowed by vehicle only with a special use permit and which is not allowed via river boat.

Pressure has grown to allow greater public use. But a lack of funding has meant there was not enough staff to manage public use activities. As a result, the refuge has remained closed.

Visitor Safety

The refuge acquisition boundary is bisected from north to south by the Union Pacific Railroad. Several tracts owned by the refuge are within this area. Thus, access to portions of the refuge requires crossing the railroad track, which poses a danger.

Concerns about visitor safety have been few because public access is limited to a small number of special use permit holders.

River Boating

River boating is not allowed on the Bear River within the refuge acquisition boundary because: (1) riverflows can be reduced substantially at any of the dams and diversions, (2) inadequate access points for boat launching combined with low flows make it an unattractive recreational activity, and (3) it is not one of the six priority wildlife-dependent public uses of the Refuge System.

Hunting

We completed a hunting plan and EA in January 2012 to open designated portions of the refuge to big game, upland game, and migratory bird hunting. The hunt plan package was submitted to our headquarters, and we anticipate the refuge will be open to hunting for the first time in the fall of 2014.

Shed Antler Collecting

The collecting of shed antlers is not one of the six priority wildlife-dependent recreational activities of the Refuge System. It is considered an economic activity, and all economic activities that take place on national wildlife refuges must pass an appropriateness test to be allowed and then must be found not only compatible with a refuge's purposes but a contributor to their achievement and that of the mission

of the Refuge System. We have conducted an appropriateness test (appendix H) for shed antler hunting and found it to be inappropriate at the refuge.

The State of Wyoming has adopted shed antler collection regulations that prohibit the hunting or collection of shed antlers between January 1 and April 30. This regulation allows shed antler hunting to start at the beginning of the migratory bird nesting season. Since Cokeville Meadows Refuge was established for the protection of migratory birds and their habitats, allowing antler collectors on the refuge to conduct this activity would pose unwanted disturbance to the migratory birds. By the time most elk and deer have shed their antlers, they have moved off the refuge to the east and onto BLM lands. There is more opportunity on those lands to collect antlers than on the refuge. Thus, shed antler collecting is not an appropriate use of Cokeville Meadows Refuge, and it is not compatible with the refuge's purposes or with the Refuge System mission.

Fishing

Cokeville Meadows Refuge is not open to the public for recreational fishing, though that may change. A stepdown fishing plan will be prepared to open portions of the Bear River to fishing opportunities in accordance with WGFD fishing regulations. The fishing plan must undergo public review and comment and then be submitted to the Federal Register and be published as a final rule.

Upon approval of a fishing plan, we anticipate that WGFD staff will help to enforce activities and guide the public on refuge lands. Where the potential exists and when there is enough support, the refuge will engage partners to find sites and to develop adequate public access for sportfishing.

Trapping

Cokeville Meadows Refuge has not been open for recreational or commercial trapping, but will be open to limited recreational trapping. Limited furbearer trapping may be authorized by special permit in accordance with State regulations. Furbearers and predator species available for regulated take by trapping include beaver, mink, muskrat, bobcat, red fox, badger, weasel, skunk and raccoon.

Wildlife Observation and Photography

Wildlife observation and photography are only allowed at the public use facilities located at the Netherly Slough, though we may seek to open more of the refuge to these uses. We will also work with partners to find areas where facilities and opportunities can be enhanced to improve these activities.

Environmental Education and Interpretation

Environmental education and guided interpretation are provided by refuge staff, volunteers, or partners on request and when resources allow. Staff-lead programs are limited. We plan to add self-guided interpretive opportunities such as brochures and walking trails.

Public Information

Public information is available at the refuge office and at the Seedskaadee National Wildlife Refuge Complex headquarters and Web site, by way of the Cokeville Meadows Refuge link. The refuge does not currently have a general information brochure. We would like to expand the public information program at Cokeville Meadows Refuge to include the development of brochures and leaflets.

Human History and Cultural Resources

This section describes the human history and cultural resources found at Cokeville Meadows Refuge.

Prehistoric Era

Current archaeological evidence shows that the earliest human inhabitants of the area, referred to as paleo-Indians, migrated to the region near the close of the last ice age approximately 12,000 years ago. These people had a highly mobile lifestyle that depended on the hunting of large animals, including mammoths and huge, now-extinct bison species. The hallmarks of most paleo-Indian sites are the beautiful, but deadly, spear points that are recovered from

animal kill and butchering sites, small temporary camps, or isolated occurrences.

There was a gradual, but definite, shift in the pattern of human use of the region beginning about 8,500 years ago that continued until approximately 1,800 years ago. The changes during this period, referred to as the Archaic Period, were the result of a combination of a growing population, technological innovation, and regional influences. Regional climatic changes also had a strong influence.

It is clear that the environmental conditions of early portions of the Archaic Period were affected by an Altithermal Climatic Period, characterized by a hotter, dryer climate that negatively affected human populations (James Enterprises, Incorporated 2003). The Altithermal was supplanted by the cool and wet Neoglacial Climatic Period during later portions of the Archaic Period (Johnson and Pastor 2003). As

these environmental changes affected floral and faunal communities, cultures adjusted settlement and subsistence strategies accordingly (James Enterprises, Incorporated 2003).

The Archaic Period is better represented in the archaeological record than the preceding Paleo-Indian Period with a greater variety of tools and the evidence of a larger variety of plant and animal use found on many of the sites from that time. Houses built in shallow depressions (pit houses), generally smaller spear points, ground stone that reflects food processing, a wide variety of animal remains, a diverse tool assemblage, and multiple fire features are all often found on Archaic Period sites.

The Late Prehistoric Period began approximately 1,800 years ago and ended 250–300 years ago when European influences began to alter Native American cultures. The development of the bow and arrow, advancements in ceramic production, influences from neighboring regions, and a variety of features are hallmarks of sites dating to this period. Although population increases during this time are reflected in the increased number of sites, people continued to move about the landscape in small groups between periods of more sedentary lifestyles.

Between Anno Domini 1700 and 1750, the beginning of the Protohistoric Period, Europeans and their material culture began to have a significant influence on the native populations. By the early 1700s, horses were introduced to the region, and, over the next several decades, trade and settlement increased at a steady and sometimes accelerated rate. The Shoshone were the dominant Late Prehistoric Period and Protohistoric Period Native Americans in the region. Other Native American tribes, including the Crow, Ute, Comanche, Salish, Arapahoe, Cheyenne, Sioux, and the Gros Ventre, also inhabited, or passed through, southwestern Wyoming (Backer et al. 2001, Thompson and Pastor 1995). By the beginning of the Historic Era, the Eastern Shoshone Tribe and the closely allied Northern Shoshone-Bannock Tribe inhabited the area, at which time it was less frequently used by the Ute, Arapahoe and Cheyenne tribes.

Historic Era

The Historic Era of the Cokeville Meadows Refuge region began in the early 1800s and continued through World War II. Some of the first people of European descent in the region were the diverse and independent early trappers and explorers often referred to as mountain men. The height of mountain men activity in southwestern Wyoming encompasses the years from about 1810 to 1840 and was closely aligned with the rise and fall of the beaver skin trade networks. Several of their rendezvous—large gather-



FWS

The Historic Era of the Cokeville Meadows Refuge featured a great western expansion as pioneers took to one of many trails in the area, like the Oregon Trail.

ings of Mountain Men and Native Americans for beaver skin trade and exchange of various other goods—were held in the area, and many of the transportation routes used in later decades were explored and charted during this time.

Many transportation corridors crossed through the Cokeville Meadows Refuge area. Four major trail systems, the Oregon trail, the Mormon trail, the Overland trail, and the Emigrant trail, carried hundreds of thousands of people as they traveled west seeking new homes or fortunes. Each trail consisted of a system of primary routes and many cutoffs and side routes that often overlapped with other trails in the area. Beginning in the early to mid-1830s and continuing until 1869, these trails brought people, goods, and mail to much of the Rocky Mountain West. The completion of the transcontinental railroad in 1869 provided a quicker and easier way to travel west, and traffic along trails quickly slowed to a trickle.

The construction of the Lincoln Highway, starting in 1913, running just south of the refuge, allowed automobile traffic through the area.

The historical military presence in the refuge area was closely associated with the early trails and the need to move goods across the frontier. Fort Bridger, located approximately 40 miles to the south-southeast of the refuge, was a vital trading and military post from the early 1840s to 1890 and served as a resupply point for many of the wagon trains as they continued west. Confrontations with Native Americans occurred during the early years and increased as settlers poured into the region. The Fort Laramie Treaties of 1851 and 1868 were attempts to quell the increasing conflicts but yielded limited results. By the 1860s, the hostilities worsened, and many battles and skirmishes ensued. By 1890, the tribes had been moved off their lands and relocated to reservations.

The Homestead Acts of 1862 and 1909, along with many other acts that encouraged settlement and industry, started a boom and bust cycle that, to some extent, continues to the present. Industries, including charcoal production, coal mining, railroad tie manufacture, and oil exploration, in addition to cattle and sheep ranching, spurred the fast establishment of many settlements and small towns, many, of which, faded as quickly as they appeared.

Cokeville, Wyoming, is situated at the confluence of the Bear River and Smith's Fork valleys. Between 1812 and 1828, these valleys were the domain of Native Americans, fur trappers, and traders; during the 1830s and 1840s they became a well-traveled pathway of emigrant trains traveling to Oregon and California. Known as "Smith's Fork on the Bear River" to fur trappers and pioneers, Cokeville acquired its permanent name after the discovery of

nearby coal deposits that produced coke, an intense burning, and virtually smokeless product.

The Mormon Church sent the first permanent settlers to the area in 1874 to found a community. Sylvanus Collett and Robert Gee arrived with their families at the Smith's Fork River, soon to be followed by the John Bourne family. The men trapped, hunted, and traded hides, furs, and extra meat for supplies in Evanston, Wyoming, about 70 miles south. The trip to Evanston was arduous; winter journeys were sometimes made on the frozen Bear River. The launching of the Oregon Short Line in 1881 made travel easier. The railroad stimulated trade, changing the center of the main settlement to the vicinity of the tracks.

Before 1906, Cokeville consisted of two saloons, a hotel, a general store, and boarding houses. In the next nine years it incorporated and added a state bank, a newspaper, a water system, and electric lighting. In 1922, Cokeville made national headlines when Ethel Stoner became mayor and two other women won seats on the town council. They ran on a law enforcement ticket, though, once in office, they found that the local police were disinclined to enforce Prohibition laws that were then in force.

After U.S. Highway 30 was commissioned through the town in 1926, then surfaced with oil in 1935, Cokeville found itself on a major cross-country route. The highway continues to play an important role in the town's economy (BLM 2004).

Identified Cultural Resources of the Refuge

Although many cultural resource sites have been recorded near Cokeville, Wyoming, few have actually been documented on the Cokeville Meadows Refuge. This lack of information reflects the relatively low potential for resources on most of the refuge because of its extensive wetlands and the lack of cultural resource surveys. Four resources, all historic, have been recorded; and their eligibility for the National Register of Historic Places has been decided:

- Depot or Thornock Property (site 48LN3936). Consensus: not eligible as of June 10, 2002.
- Etcheverry Property or Bear River Ranch (site 48LN4119). Consensus: not eligible as of October 25, 2004.
- Antelope Property (site 48LN4120). Field not eligible as of June 15, 2004.

- Beckwith and Quin Canal (site 48LN2711).
Consensus: not eligible as of June 1, 2009.

Based on the USGS topographic map, several unrecorded ditches, water control structures, transportation-related features, and ranch structures are located on the refuge. Prehistoric sites, if present, are likely located in the upland areas of the refuge.

We will seek to develop a program that will find and interpret significant cultural resources in the area such as historic trails. Portions of the Oregon-California Trail System exist within the refuge acquisition boundary, but we do not now own them.

Law Enforcement

Law enforcement on the refuge is provided by a full-time Federal wildlife officer and a dual-function Federal wildlife officer, both stationed at Seedskaadee National Wildlife Refuge. We seek and support cooperative law enforcement help from WGFD and the Lincoln County Sheriff's Department.

3.4 Partnerships

Cokeville Meadows Refuge actively expands its many partnerships. We see that partnerships, both on and off the refuge, are important ways to accomplish wildlife-dependent goals. These include coordination with WGFD to conduct wildlife disease control, surveys and monitoring, and habitat improvement projects both on and off the refuge. We also engage in partnerships with local, State, and Federal agencies, nongovernment organizations, local landowners, cooperators, and private corporations.

Our Partners for Fish and Wildlife Program is active in the refuge area providing technical help and cost-share projects to help landowners improve wildlife habitat on private land. When possible, our refuge staff work closely with the Partners biologist on projects that can help wildlife on both private and refuge lands.

The refuge does not now have, but would like to develop, a Friends group.

Landscape Conservation

We coordinate with Bear River Watershed Conservation Area partners to enhance and preserve wildlife habitat connectivity, and we would like to

strengthen these efforts. However, because the refuge is not staffed, we are often limited to conservation activities within the refuge boundary.

3.5 Socioeconomic Environment

Cokeville Meadows Refuge is located in Lincoln County in the southwest corner of Wyoming. The county serves as a good starting point for evaluating the socioeconomic environment of the refuge.

Current Land Types and Uses

Lincoln County lies in the region known as the Upper Bear River area, where the land cover is made up primarily of grasslands and shrublands. It is estimated that about 75 percent of the land in this region is used for grazing (Utah Water Research Laboratory 2011). As of 2006, about 63 percent of the land in the Upper Bear River area counties was in Federal ownership, mostly under the BLM and USDA Forest Service. About 24 percent of the land is privately owned, 4 percent is owned by the States of Utah or Wyoming, and 7 percent is owned by Native American tribes (Conservation Biology Institute 2006).

County Population

Since the year 2000, Wyoming's population has increased by approximately 14 percent (U.S. Census Bureau 2010). Lincoln County has grown by 24 percent since 2000 with an estimated total population of 17,961 persons in 2012 (U.S. Census Bureau 2013). From 2000 to 2010, Lincoln was the fastest growing Wyoming county in the Bear River watershed. It is estimated that approximately 200 new homes are being built within Lincoln County each year (Royster and Gearino, 2006). While the total population and population density of this county is relatively sparse (table 5), the population of this area of the country is expected to continue growing apace with the Cache Valley area of Wyoming (U.S. Census Bureau 2010).



Todd Gallion / FWS

*A meeting of the planning team.***Table 5. Population, income, education, unemployment, and poverty rate statistics for Lincoln County, Wyoming.**

Residents (2010) ²	18,106
Persons per Square Mile ⁴	4.4
Percentage Population change since 2000 ⁴	+24
Median household income (2009) ⁴	\$59,160
Percentage of the population with a bachelor's degree or higher ³	17
Percentage unemployed in 2008 ¹	3.6
Percentage unemployed in 2011	6.6
Percentage of individuals below poverty (2009) ⁴	8

Source: ¹(Bureau of Labor Statistics 2008), ²(Bureau of Labor Statistics 2011a), ³(Bureau of Labor Statistics 2011b), ⁴(U.S. Census Bureau 2009).

Ethnicity and Education

In 2010, only 2 percent of Lincoln County's population identified themselves as Hispanic or Latino, while the rest of the population in the county identified themselves as white (U.S. Census Bureau 2010). The rate of individuals possessing degrees in higher education in this county is 23 percent.

Economy, Employment, Income, Recreation and Industries

Wyoming's poverty rate in 2009 stood at 10.2 percent. By contrast, Lincoln County had a poverty rate in 2009 lower than the statewide average (8 percent) and a median household income level (\$59,160), which is higher than the statewide average (U.S. Census Bureau 2010).

Forestry, fishing, hunting, agriculture, and mining accounted for roughly 19 percent of total jobs in Lincoln County (U.S. Census Bureau 2011). Employment in timber is a small fraction of total employment and has decreased since 1999 (U.S. Department of Commerce 2010).

Following the national trend, wildlife viewing has become increasingly popular, while hunting and fishing have decreased or remained stable in popularity in and around Lincoln County. Statewide, for residents 16 years of age and older, 84 percent of individuals surveyed watched wildlife, 39 percent fished, and 19 percent hunted in Wyoming. (FWS 2008).

3.6 Operations

Operations at the refuge were limited from 1992 until 2002. A small budget was allocated in 2002, and a dedicated assistant manager was hired in 2004 but has since left the refuge. Other staff or resources to support refuge operations and maintenance have come from the headquarters at Seedskaadee National Wildlife Refuge Complex. In 2008 funding was provided for a new building at the refuge and for the demolition of existing, dilapidated structures. The new building was completed in December 2009.

The following is a description of what constructed items exist on the refuge today and what is needed for the refuge to develop and operate. Topics include staff, equipment, facilities, railroad facilities, junk and debris, refuge mineral rights and energy development, and volunteers programs.

Funding and Staff

Cokeville Meadows Refuge is not currently staffed. Since 1993, our staff headquartered at the Seedskaadee National Wildlife Refuge Complex in Sweetwater County, Wyoming, has managed Cokeville Meadows Refuge. The Seedskaadee National Wildlife Refuge Complex staff of five full-time equivalent positions and two to three seasonal employees are

responsible for management activities at Seedskadee National Wildlife Refuge as well for Cokeville Meadows Refuge. The two refuges total 36,489 acres. Staff from Seedskadee National Wildlife Refuge Complex travel approximately 83 miles to work at the refuge.

In addition, Refuge System administrative staff support the Seedskadee National Wildlife Refuge Complex as part of a business team concept. Remotely stationed in Utah, Wyoming, Montana, and Colorado, they provide assistance with contracting, budget tracking, travel, and payroll.

Table 6 illustrates staff needs at Seedskadee National Wildlife Refuge Complex.

Equipment

The refuge has limited equipment to conduct refuge and maintenance operations. Some of the equipment is in poor condition and needs replacement. However, Seedskadee National Wildlife Refuge has a good fleet of equipment, and the two refuges share these resources.

Facilities

One multipurpose building on the refuge houses an office, a maintenance shop, cold storage, and a two-bedroom apartment. Other facilities include many dikes and water control structures, stock fences, gates, two-track service roads, the Pixley Dam (of which we own about half), multiple wells and pumps, a center pivot irrigation system, and four old buildings that are in need of demolition and removal.

There are two diversion dams on the Bear River within the refuge's acquisition boundary. Upstream, the BQ Dam provides water to several thousand acres of wet meadow and wetland habitats on both sides of the river via the BQ East and BQ West canals. The Pixley Dam is located in the center of the refuge boundary and provides irrigation water to several thousand more acres of wet meadow and wetland habitats along the Bear River via the Pixley East and Pixley West canals. Both dams are in bad condition, and the Pixley Dam needs to be replaced.

Public use facilities on the refuge include a parking lot, information kiosk, and short nature trail located near Netherly Slough, along Highway 30, on the east side of the refuge.

Table 6. Staff needs at Seedskadee National Wildlife Refuge Complex, Wyoming..

<i>Official title</i>	<i>Working title</i>	<i>Series, grade</i>	<i>Full-time equivalent position</i>	<i>Assignment</i>	<i>Stationed at</i>
Permanent staff					
Wildlife refuge manager	Complex manager	GS-0485-13	1	Seedskadee Refuge Complex	Seedskadee Refuge
Wildlife refuge manager	Deputy project leader	GS-0485-11	1	Cokeville Meadows Refuge	Cokeville Meadows Refuge
Wildlife refuge specialist	Wildlife refuge specialist	GS-0485-09	1	Seedskadee Refuge Complex	Seedskadee Refuge
Wildlife biologist	Wildlife biologist	GS-0485-09/11	1	Seedskadee Refuge	Seedskadee Refuge
Engineering equipment operator	Maintenance worker	WG-5716-10	1	Seedskadee Refuge	Seedskadee Refuge
Maintenance worker	Maintenance worker	WG-4749-08	1	Seedskadee Refuge	Seedskadee Refuge
Biological science technician	Biological science technician	GS-0404-07	1	Seedskadee Refuge Complex	Cokeville Meadows Refuge
Federal wildlife officer	Federal wildlife officer	GL-1801-09	1	Seedskadee Refuge Complex	Seedskadee Refuge
Temporary, term, and seasonal staff (as money allows)					
Biological science tech (temp)	Biological science tech (Temp)	GS-0404-05	0.5	Seedskadee Refuge Complex	Seedskadee Refuge
Biological science tech (temp)	Biological science tech (Temp)	GS-0404-03	0.5	Cokeville Meadows Refuge	Cokeville Meadows Refuge

Railroad Facilities

The Union Pacific Railroad bisects the Cokeville Meadows Refuge acquisition boundary from north to south and has facilities in the area.

Junk and Debris

Junk piles and unwanted property on the refuge pose risks to human safety and health.

Land Protection

The refuge is working with partners and local governments to prevent development by attempting to acquire lands in fee title or through conservation easements to reduce the threat of urban encroachment and habitat conversion.

Private lands outside the refuge acquisition boundary are being developed and turned into housing projects or converted and further developed via center pivot irrigation systems. It is anticipated that, in the short term, some private land within the acquisition boundary will also start to be developed.

Refuge Mineral Rights and Energy Development

We do not own the mineral estate of the lands we hold in fee title at Cokeville Meadows Refuge. In the past, oil and gas were extracted from lands surrounding the refuge boundary. Some mineral development is taking place within the approved acquisition boundary and some is taking place outside, and adjacent to, the acquisition boundary. Mineral development poses threats to refuge lands and habitat within the Bear River watershed both on and off the refuge. To protect wildlife habitats from the undue effects of human activities, we seek the withdrawal of subsurface Federal mineral rights from lands within the refuge boundary that are now administered by the BLM. Where appropriate, we will attempt to secure the subsurface mineral estate of lands purchased in fee title when the opportunity arises and work to reduce or mitigate changes brought on by such development.

Where we are successful in securing subsurface mineral rights, wildlife and the habitats on which they depend will be protected for the enjoyment of

future generations. Where we are unable to secure subsurface mineral rights, wildlife and their habitats may be subjected to the temporary and permanent adverse effects of mineral development and transportation.

Pipeline and transmission line corridors have not been designated within the refuge boundary. We will evaluate requests for rights-of-way and surface disturbance on a case-by-case basis.

Inventory, Monitoring, and Research

Cokeville Meadows Refuge has never received the staff or money necessary for a scientifically sound inventory and monitoring program.

Nuisance Species and Predators

Nuisance species, whether terrestrial or aquatic, may include animals and invasive plants that could occur in some of the refuge's habitats and which threaten either the variety or abundance of native species; the stability of the ecosystem; the infrastructure of the refuge; and the commercial, agricultural, aquacultural or recreational activities that are dependent on the refuge's habitats. An animal or plant that is considered a nuisance species in a refuge because of the effects that its population size or behavioral patterns have on the refuge's habitats or infrastructure may not be considered a nuisance species on another refuge. Examples of species that at times have been considered a nuisance at Cokeville Meadows Refuge are muskrat and beaver.

The refuge also lies within the historical range of some species considered predators, such as the gray wolf, coyote, red fox, weasel, and others. Predators are an integral part of, and carry out important functions in, a healthy ecosystem. Sometimes predators that make use of refuge habitats may pose a danger to humans or cause damage to private livestock or property near the refuge. Under certain circumstances we allow these animals to be captured or lethally controlled on refuge lands (appendix I).

Volunteers Programs

The refuge operates a small volunteers program.

